Kansas Department of Transportation

TECHNICAL SUMMARY

Laboratory Evaluation of Characteristics of Recycled Asphalt Pavement in Kansas

Report Number: K-TRAN: KU-09-2 ▪ Publication Date: September 2011

Jie Han, Ph.D., P.E.
Subhash C. Thakur
Oswald Chong, Ph.D.
Robert L. Parsons, Ph.D., P.E.
The University of Kansas

Introduction

The use of recycled asphalt pavement (RAP) has been in practice since the 1930s and is necessary to reduce the construction cost due to rising prices of virgin aggregates and binder, to conserve these rapidly depleting resources, and to minimize problems associated with disposal of aged mixes. Many states and the Kansas Department of Transportation (KDOT) have been using RAP for highway construction. According to the Federal Highway Administration (FHWA), nearly 30 million tons of RAP are recycled into Hot Mix Asphalt (HMA) pavements every year and thus RAP is the most recycled material in the United States.

In 1997, a subgroup of the FHWA Superpave Mixtures Expert Task Group developed interim guidance for the use of RAP based on the past experience. These guidelines established a tiered approach for the RAP usage. The Task Group suggested that up to 15% RAP could be used with no change in binder grade. Between 15% and 25% RAP, the virgin binder grade should be decreased by one increment on both the high and low temperature grades. Above 25% RAP, blending charts should be used to determine how much RAP can be used. Most research has shown that there is no significant difference in Superpave performance when a low RAP content (10%) is used. At a higher RAP content (for example, 40%), however, the difference in the performance becomes significant.

Project Objective

The main objective of this research was to evaluate characteristics of milled Recycled Asphalt Pavements (RAP) collected from selected milled roadways in Kansas.

Recycled Asphalt Pavement and Aggregate Stockpiles

(http://www.fhwa.dot.gov/pavement/recycling/rap/index.cfm)

Project Description

The RAP was collected from three selected milled roadways including K-25 in Grant County, K-25 in Logan

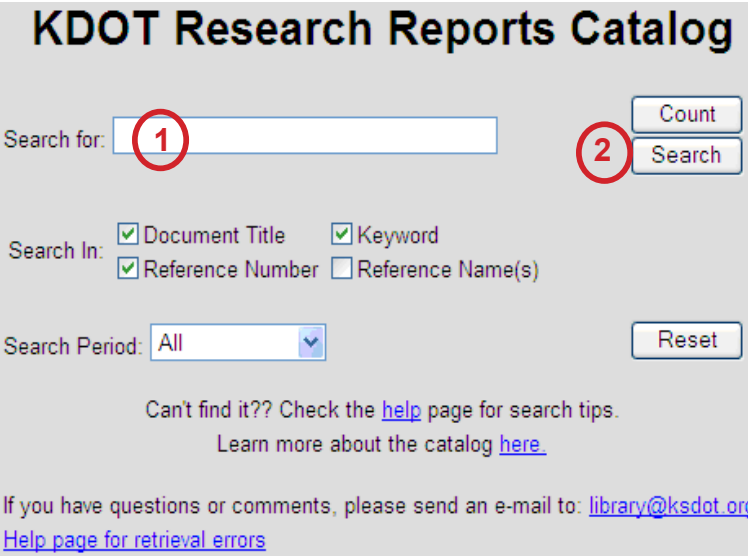
County, and US-83 in Scott County. The aggregates were extracted from RAP, and tested for characteristics including gradation, specific gravity, Fine Aggregate Angularity (FAA), Coarse Aggregate Angularity (CAA), flat and elongation (F&E), and Los Angeles (L.A.) abrasion values. Binder from each source was extracted from the RAP, and recovered for a performance grade (PG) testing. The changes in the properties of aggregates after milling from the roadways as compared with the original aggregates are discussed. The variability of RAP aggregates was analyzed. In addition, the differences between the properties of aggregates extracted by centrifuge and ignition methods are compared.

Project Results

This study was mainly focused on the laboratory evaluation of characteristics of the RAP from three project sites in Kansas. The maximum allowable percentage of RAP to be incorporated in new HMA calculated in this study just gives a rough estimate. This percentage depends on the variability of binder content and properties of aggregates extracted from RAP. In this study, their variability was small. Based on the tiered and grading systems suggested by New Jersey Department of Transportation in 2009, a higher percentage of RAP is allowed. To make a recommendation about the use of a higher percentage of RAP, performance testing and more extensive lab testing on characteristics of RAP should be done to cater the variability of RAP, but they are beyond the scope of this research. The binder test results show that the binders in RAP from three project sites in this study were significantly aged. This fact should be considered in the selection of virgin binder PG when a higher percentage of RAP is included. Aggregate property testing shows that the coarse aggregates from the RAP had one-size smaller nominal maximum particles and higher coarse aggregate angularity than those in the original mix. These changes will affect the volumetric analysis of the Superpave mix design.

Report Information

For technical information on this report, please contact: Dr. Jie Han, the University of Kansas Department of Civil, Environmental, and Archtectural Engineering, Learned Hall, 1530 W 15th Street, Lawrence, Kansas 66045-7618; 785.846.3714; 785.864.5631 (fax); jiehan@ku.edu.



Directions for Downloading the Full Report

To download the full report, visit http://www.ksdot.org/burmatrres/kdotlib2.asp and do the following:

1. Enter KU-09-2 in the search box.
2. Click the Search button to the right of the search box.
3. You may have to scroll to find the specific report.
4. To download the report, click on the title of the report to open the PDF file and save it to your hard drive.

If you have any questions, please email us at library@ksdot.org.